OBLON, SPIVAK, ET AL.
Docket No. 202686US-2-TTC
Inventor: KANEHIRA, ET AL.
Serial No. 09/774,621
In Reply to: Notice Re Drwgs of 08/05/05
Replacement Sheet

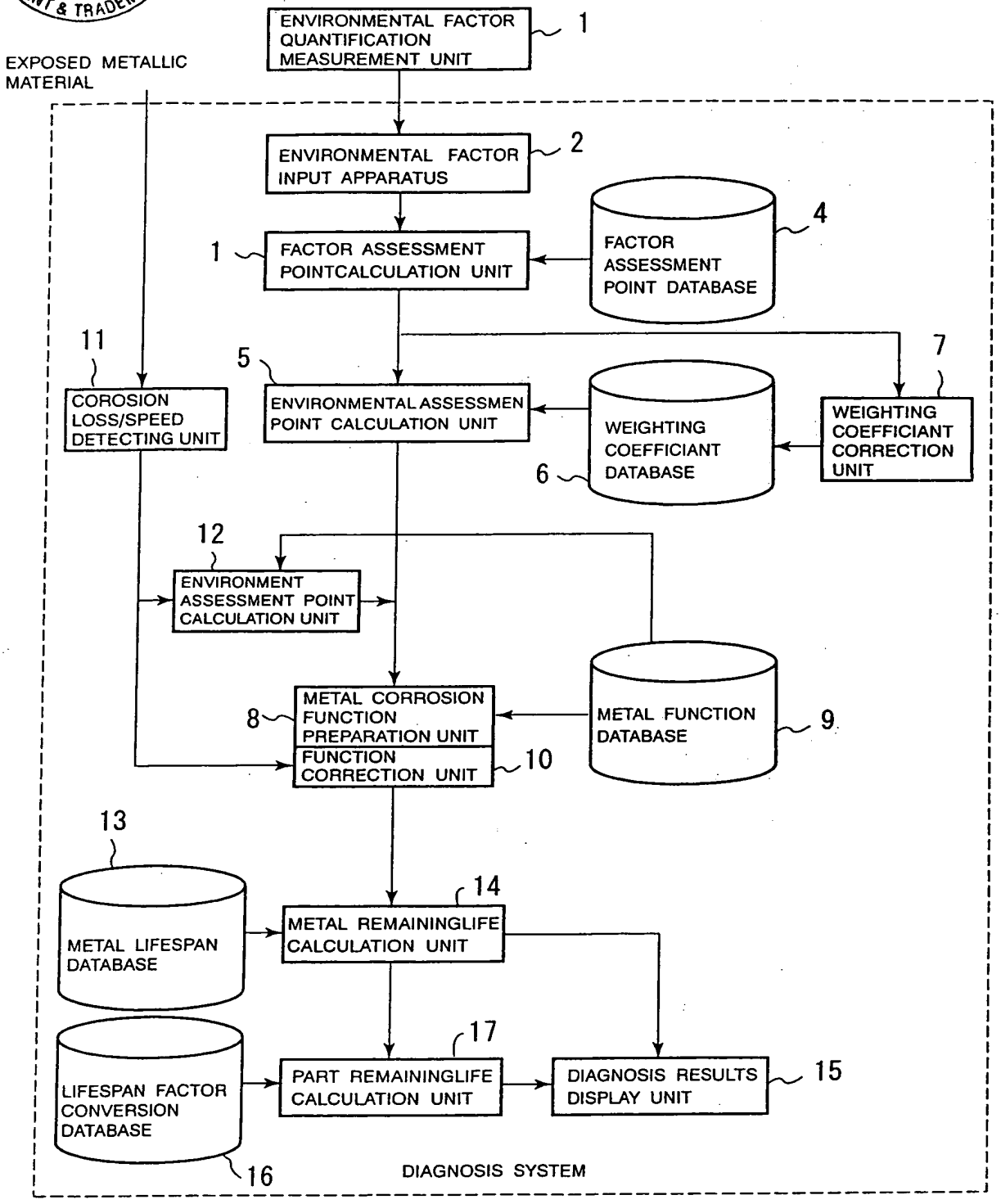


FIG.1

Atmospheric environment Zone / Environmental factors				I		II		III		IV		V	
				Measured value	Evaluation point	Measured value	Evaluation point	Measured value	Evaluation point	Measured value	Evaluation point	Measured value	Evaluation point
Temperature(°C)			A	≦20	1	≦25	2	≦30	4	≦35	8	>35	12
Relative humidity (%RH)			B	≦60	1	≦65	6	≦70	12	≦80	24	>80	36
Corrosive gas (mdd)	SO_3	SO_2	C1	≦0.02	1	≦0.05	4	≦0.2	8	≦0.5	16	>0.5	24
		H_2S	C2	≦0.02	1	≦0.05	6	≦0.2	12	≦0.5	24	>0.5	36
	NO_2		C3	≦0.02	1	≦0.05	3	≦0.2	6	≦0.5	12	>0.5	18
	Cl^-		C4	≦0.02	1	≦0.05	7	≦0.2	14	≦0.5	28	>0.5	42
	NH_3		C5	≦0.02	1	≦0.1	3	≦1.0	6	≦10	12	>10	18
Sea salt particle	Sea salt particle (mdd)		D	≦0.01	1	≦0.03	5	≦0.1	10	≦0.3	20	>0.3	30
	Distance from coast (km)			>2.0		≧1.5		≧1.0		≧0.5		<0.5	

FIG.2

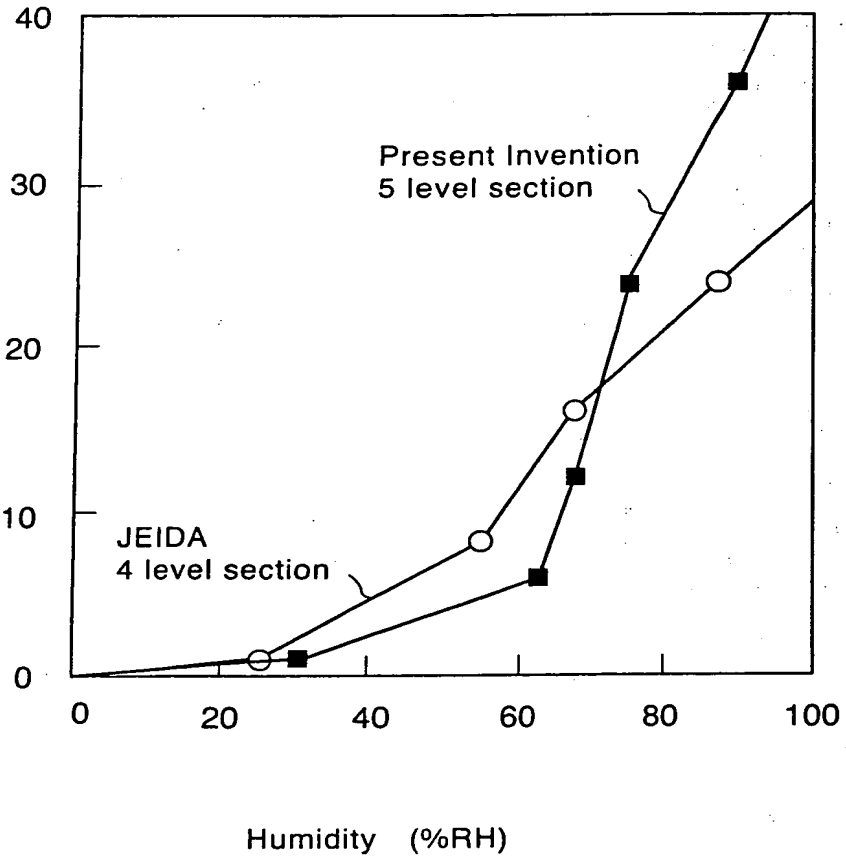

40
30
20
10
0
0
20
40
60
80
100
Present Invention
5 level section
JEIDA
4 level section
Humidity (%RH)

FIG.3

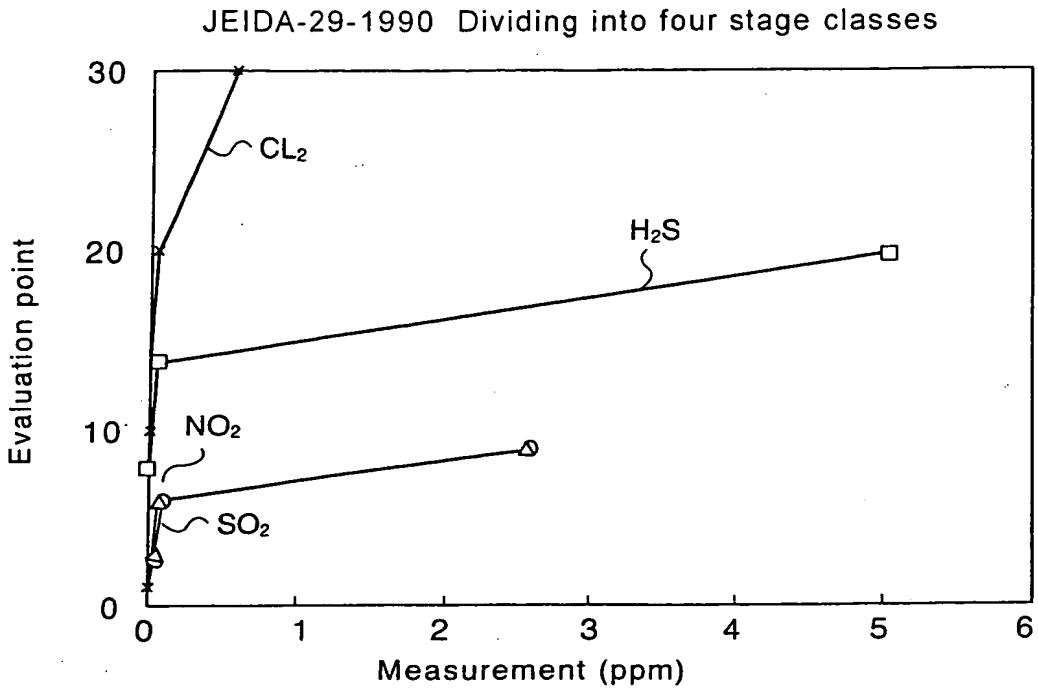

JEIDA-29-1990 Dividing into four stage classes
Evaluation point
Measurement (ppm)
30
20
10
0
0
1
2
3
4
5
6
CL2
H2S
NO2
SO2

FIG.4A

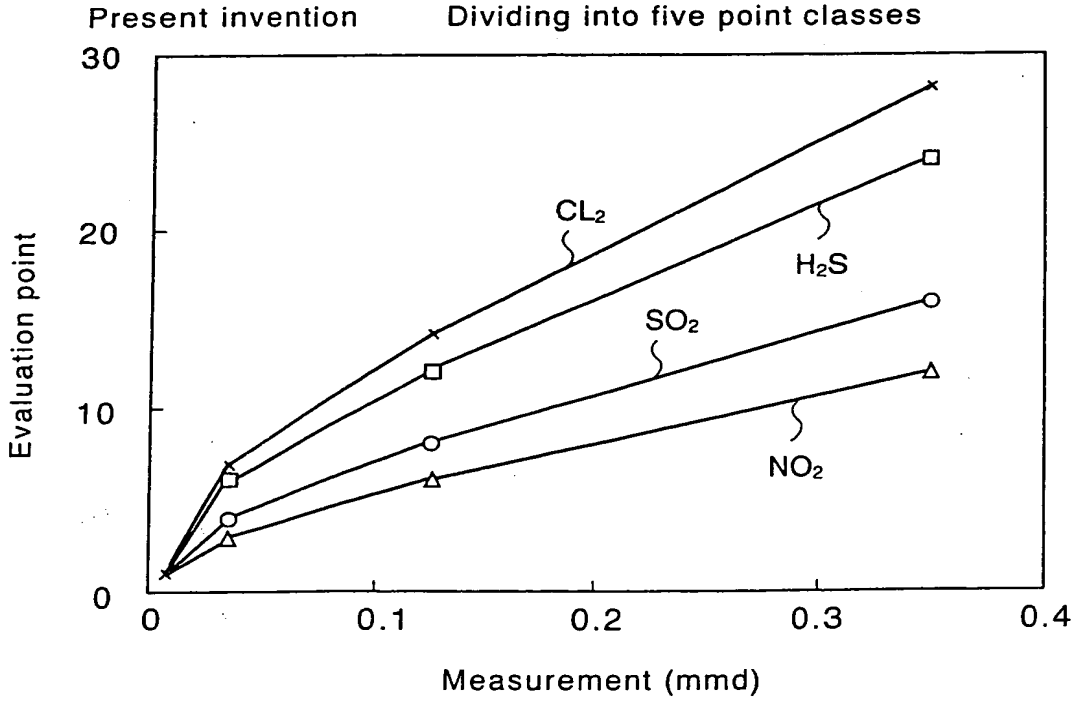

Present invention
Dividing into five point classes
Evaluation point
Measurement (mmd)
30
20
10
0
0
0.1
0.2
0.3
0.4
CL2
H2S
SO2
NO2

FIG.4B

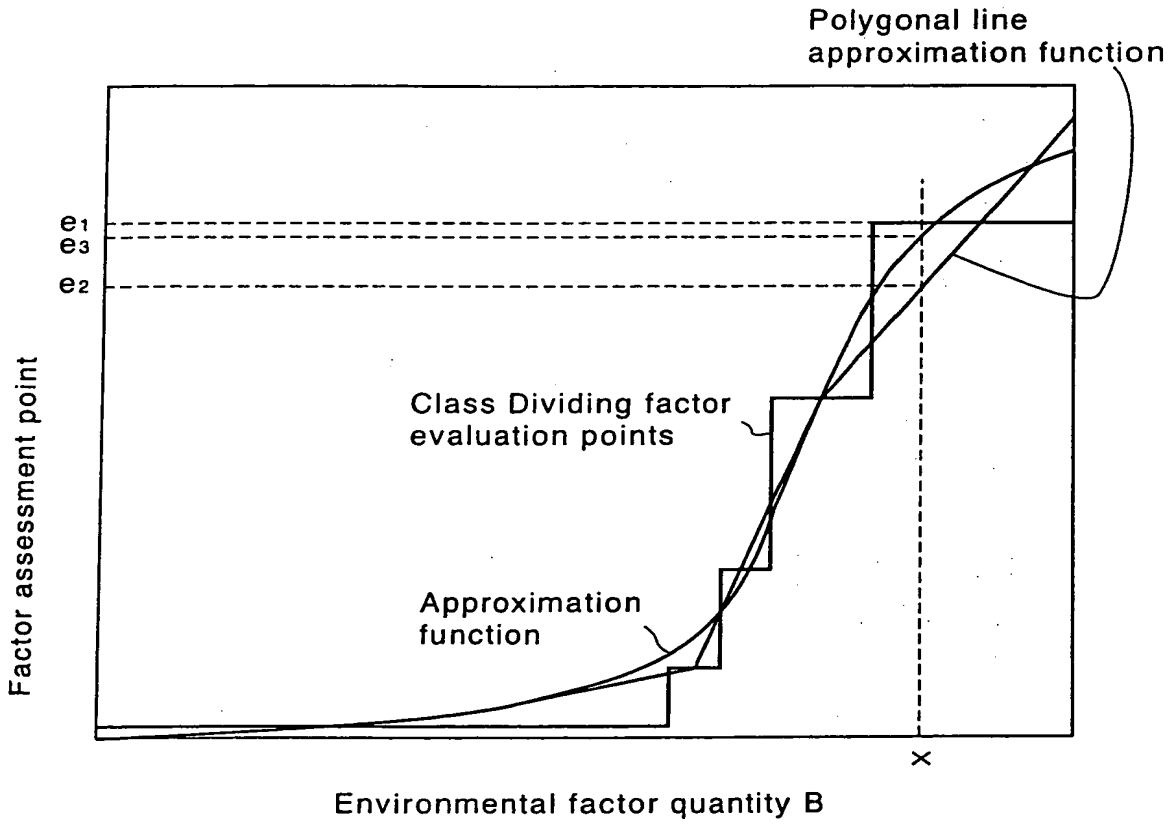

Polygonal line
approximation function
e1
e3
e2
Class Dividing factor
evaluation points
Approximation
function
Factor assessment point
X
Environmental factor quantity B

FIG.5

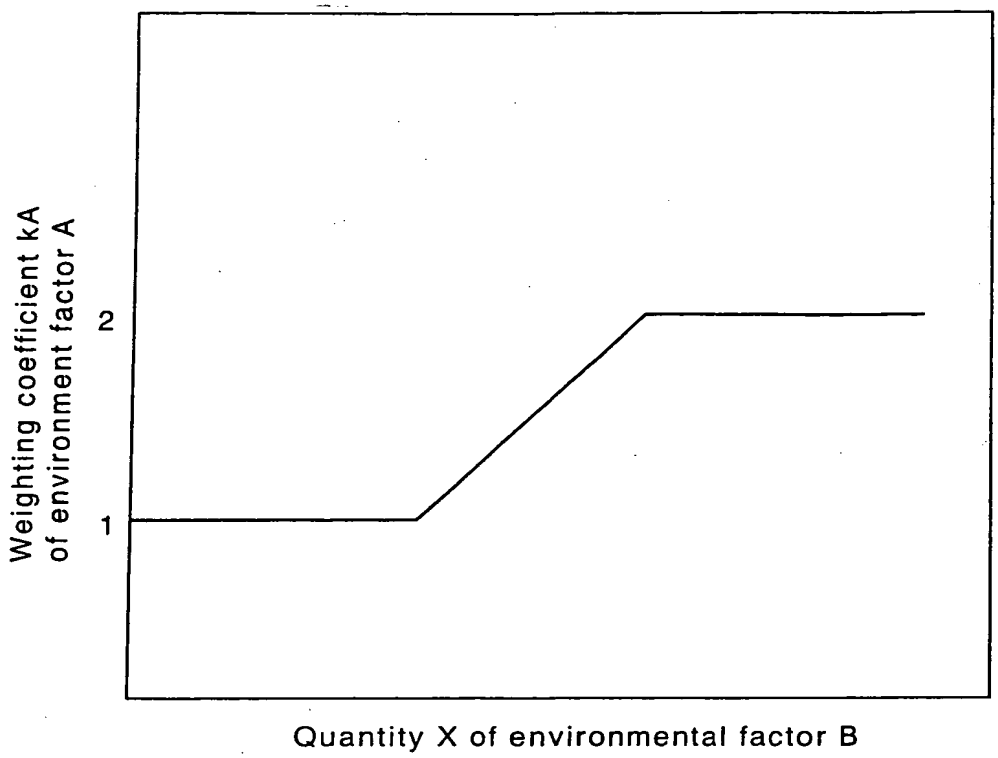

Weighting coefficient kA
of environment factor A
2
1
Quantity X of environmental factor B

FIG.6

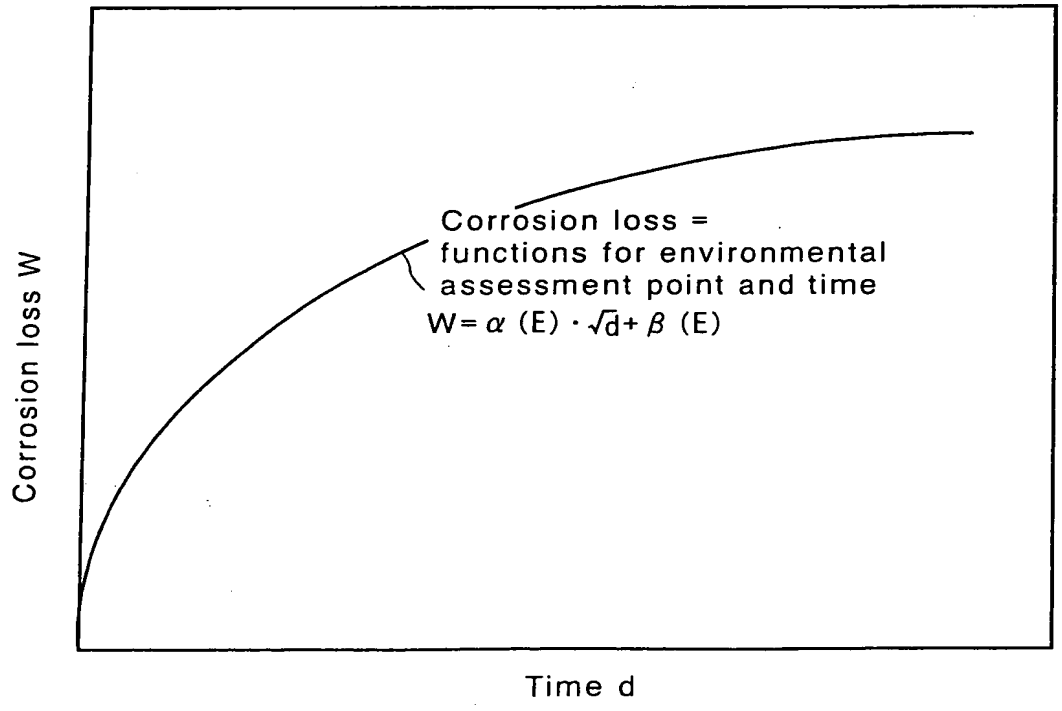

Corrosion loss W
Corrosion loss =
functions for environmental
assessment point and time
W= α (E) · √d + β (E)
Time d

FIG.7

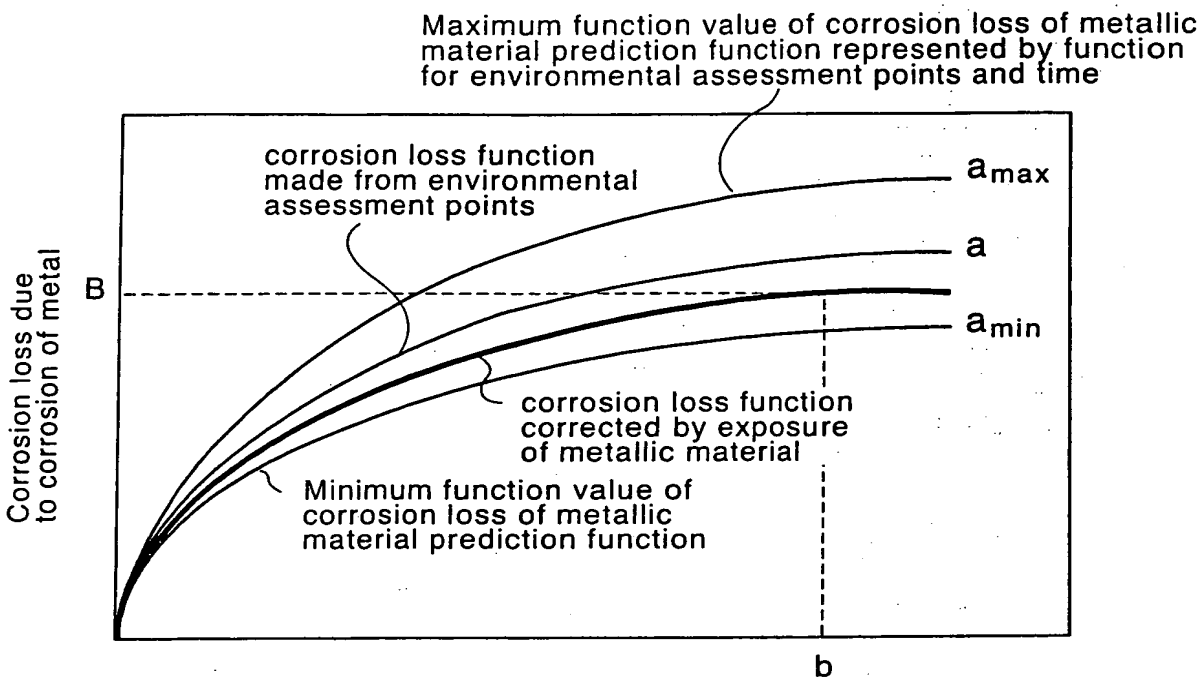

Maximum function value of corrosion loss of metallic material prediction function represented by function for environmental assessment points and time
corrosion loss function made from environmental assessment points
a_{max}
a
a_{min}
B
Corrosion loss due to corrosion of metal
corrosion loss function corrected by exposure of metallic material
Minimum function value of corrosion loss of metallic material prediction function
b

FIG.8

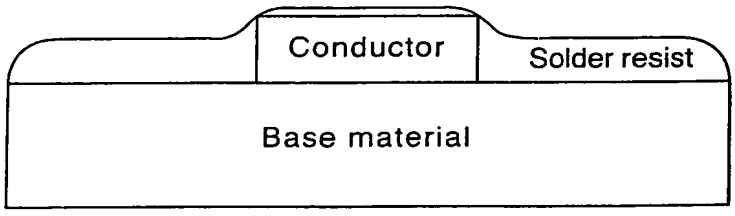

Conductor
Solder resist
Base material

FIG.9

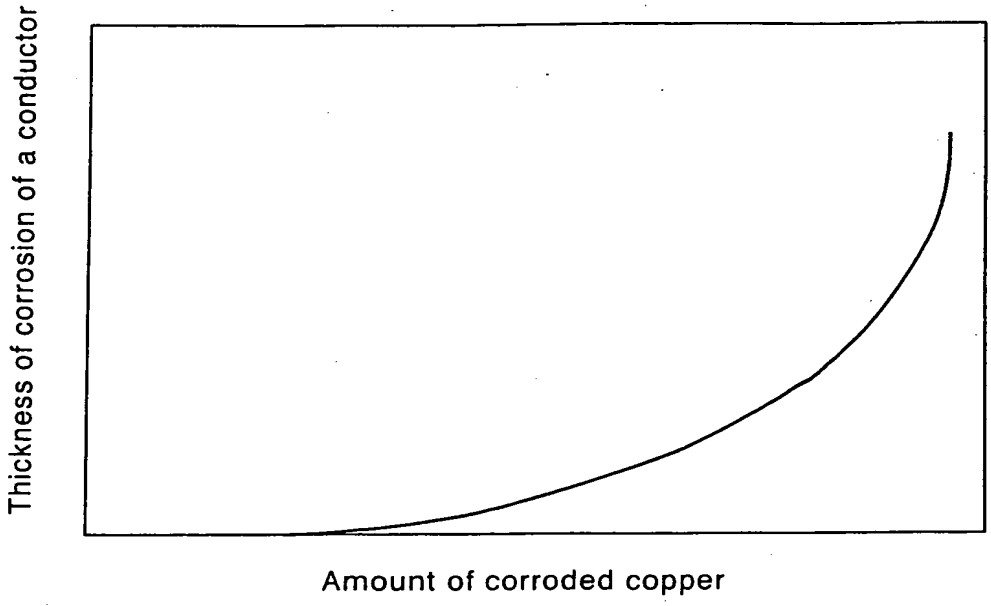


FIG.10A

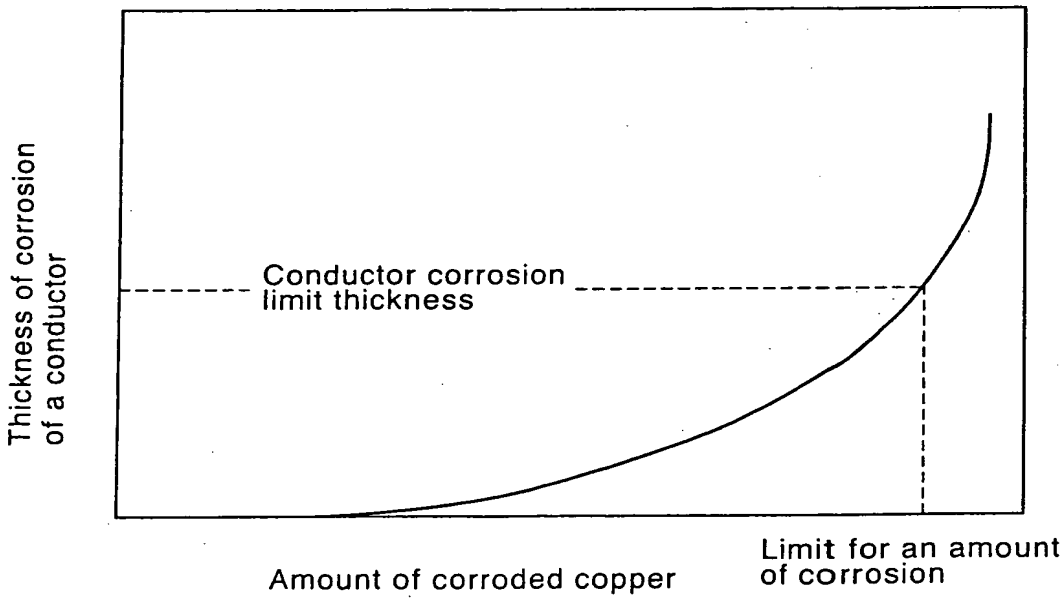
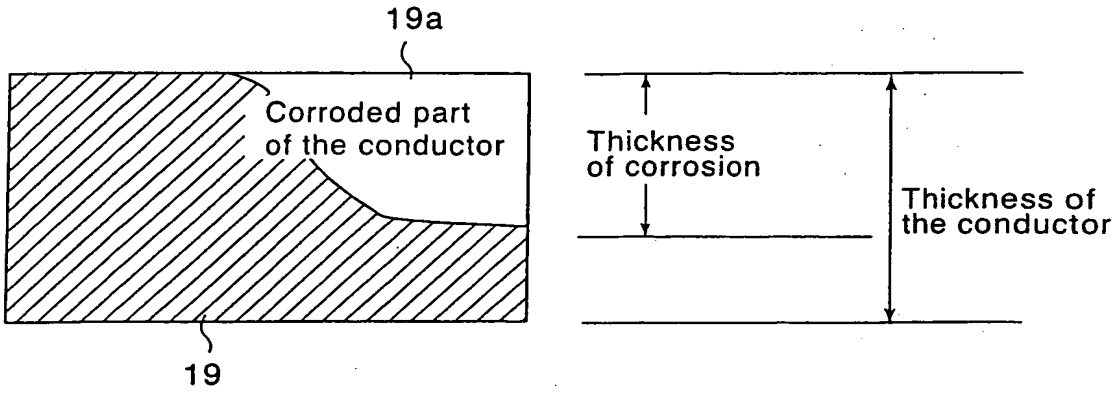


FIG.10B



Corrosion loss rate=(thickness of corrosion／thickness of the conductor) × 100

FIG.11

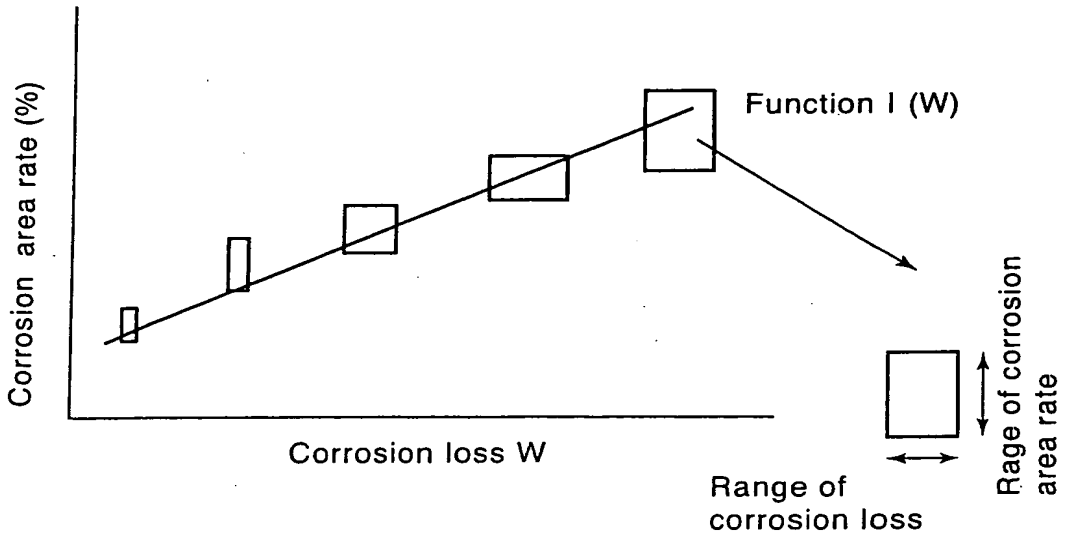


FIG.12

IC type	Year	Manufacturer	Sealing resin	Chip protective film	Other...	Correlation function(W)
IC1	1982	T Inc.	Epoxy blend---	PSG		$I_1(W)$
IC2	1979	N Inc.	Epoxy blend---	None		$I_2(W)$
IC3	1992	T Inc.	Epoxy blend---	SiN		$I_3(W)$
...	...	...	...	...	...	...

FIG.13

IC type	Year	Manufacturer	Sealing resin	Chip protective film	Other...	Change of time sequence of aluminium wiring corrosion area rate Ui = hi(t) Correlation function F(u) of aluminium wiring corrosion area rate and faults
IC1	1982	T Inc.	Epoxy blend---	PSG		$U_1=m_1(t),F_1=n_1(u)$
IC2	1979	N Inc.	Epoxy blend---	None		$U_2=m_2(t),F_2=n_2(u)$
IC3	1992	H Inc.	polyimide blend---	SiN		$U_3=m_3(t),F_3=n_3(u)$
...	...	...	...	...	...	...

FIG.14

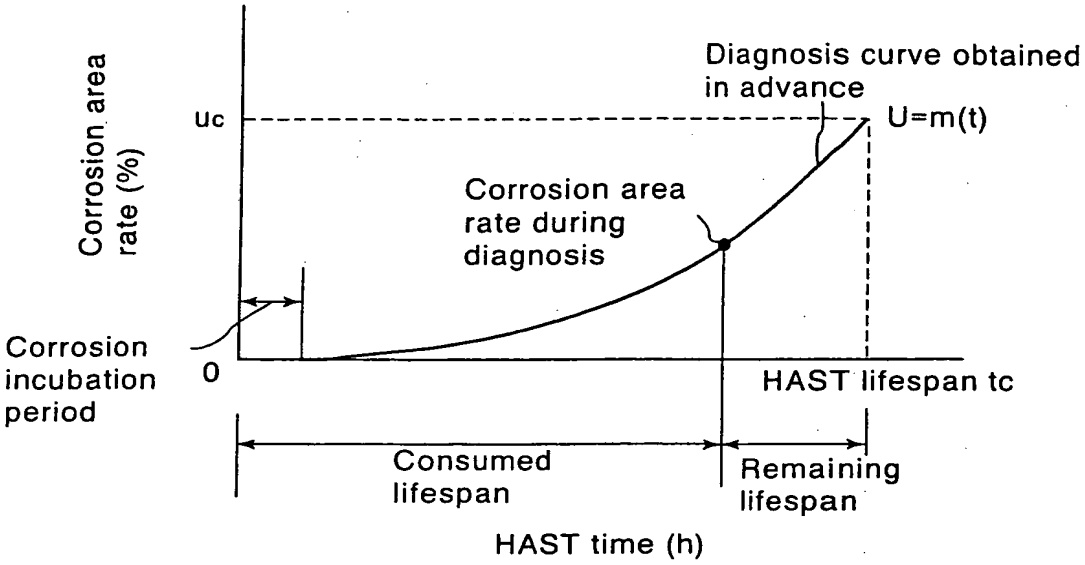

Corrosion area rate (%)
uc
Diagnosis curve obtained in advance
U=m(t)
Corrosion area rate during diagnosis
Corrosion incubation period
0
HAST lifespan tc
Consumed lifespan
Remaining lifespan
HAST time (h)

FIG.15

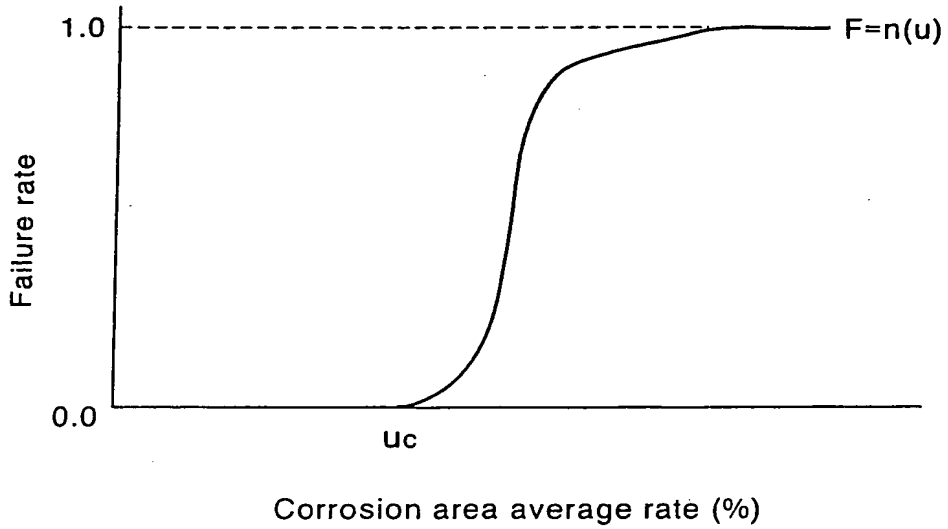

1.0
F=n(u)
Failure rate
0.0
uc
Corrosion area average rate (%)

FIG.16

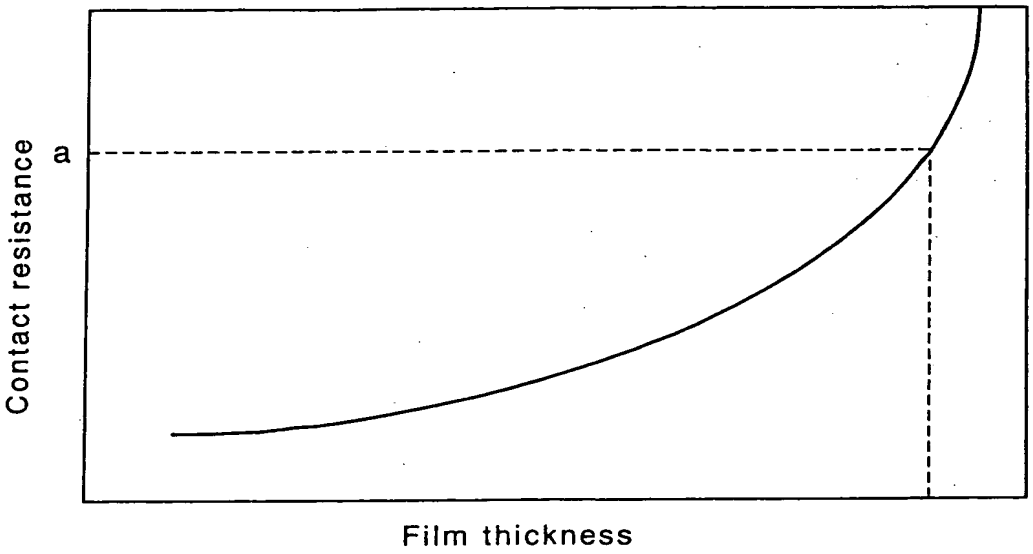

Contact resistance
a
Film thickness

FIG.17

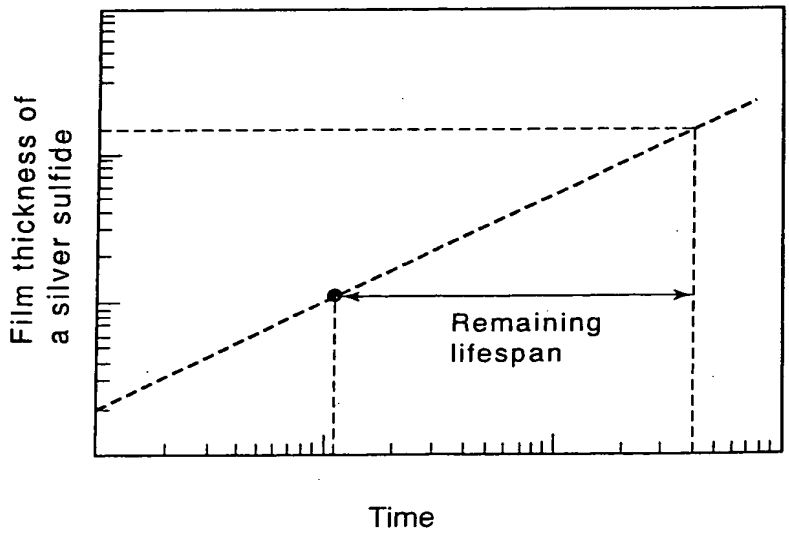

Film thickness of a silver sulfide
Remaining lifespan
Time

FIG.18

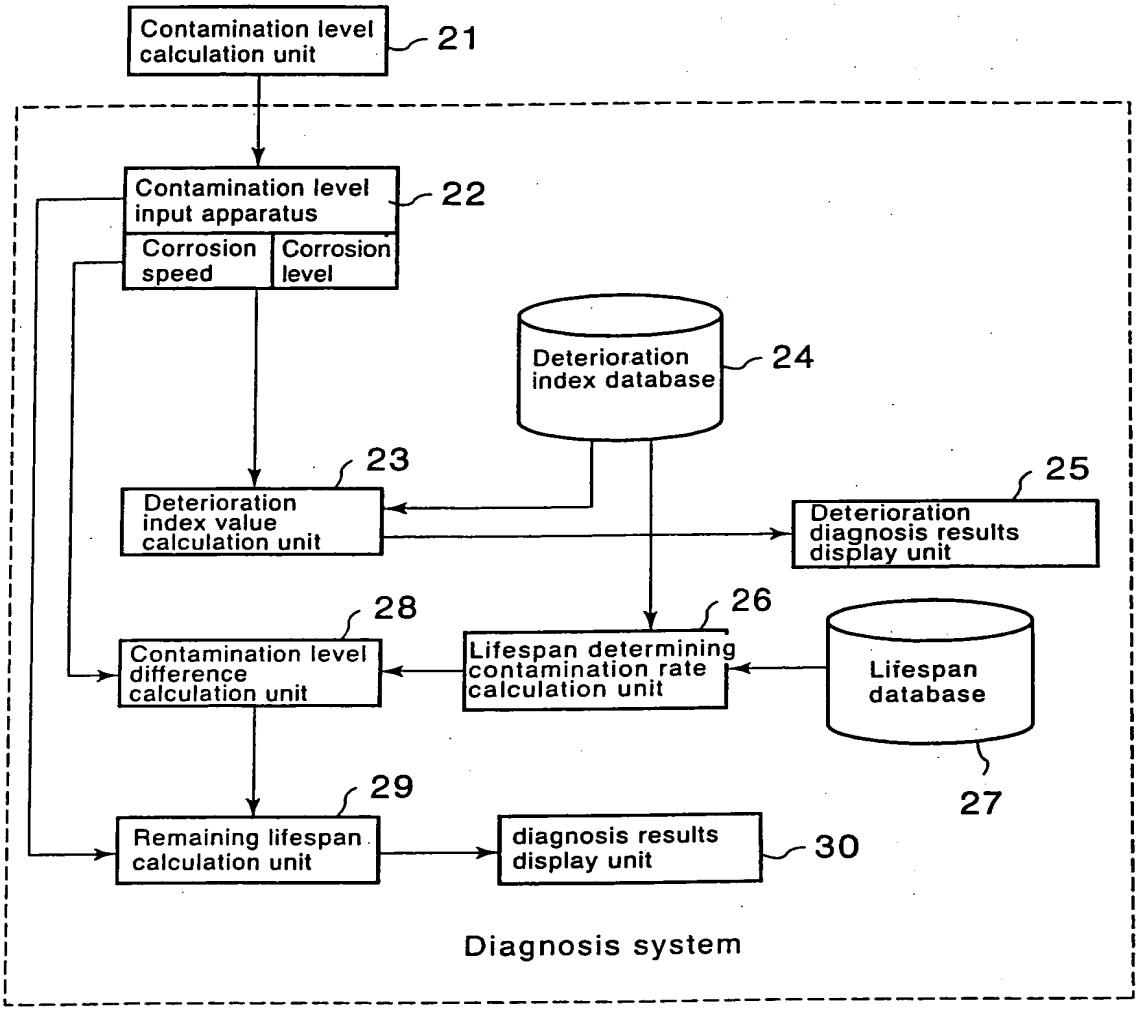

Contamination level calculation unit
21
Contamination level input apparatus
22
Corrosion speed
Corrosion level
Deterioration index database
24
23
Deterioration index value calculation unit
25
Deterioration diagnosis results display unit
28
26
Contamination level difference calculation unit
Lifespan determining contamination rate calculation unit
Lifespan database
27
29
Remaining lifespan calculation unit
diagnosis results display unit
30
Diagnosis system

FIG.19

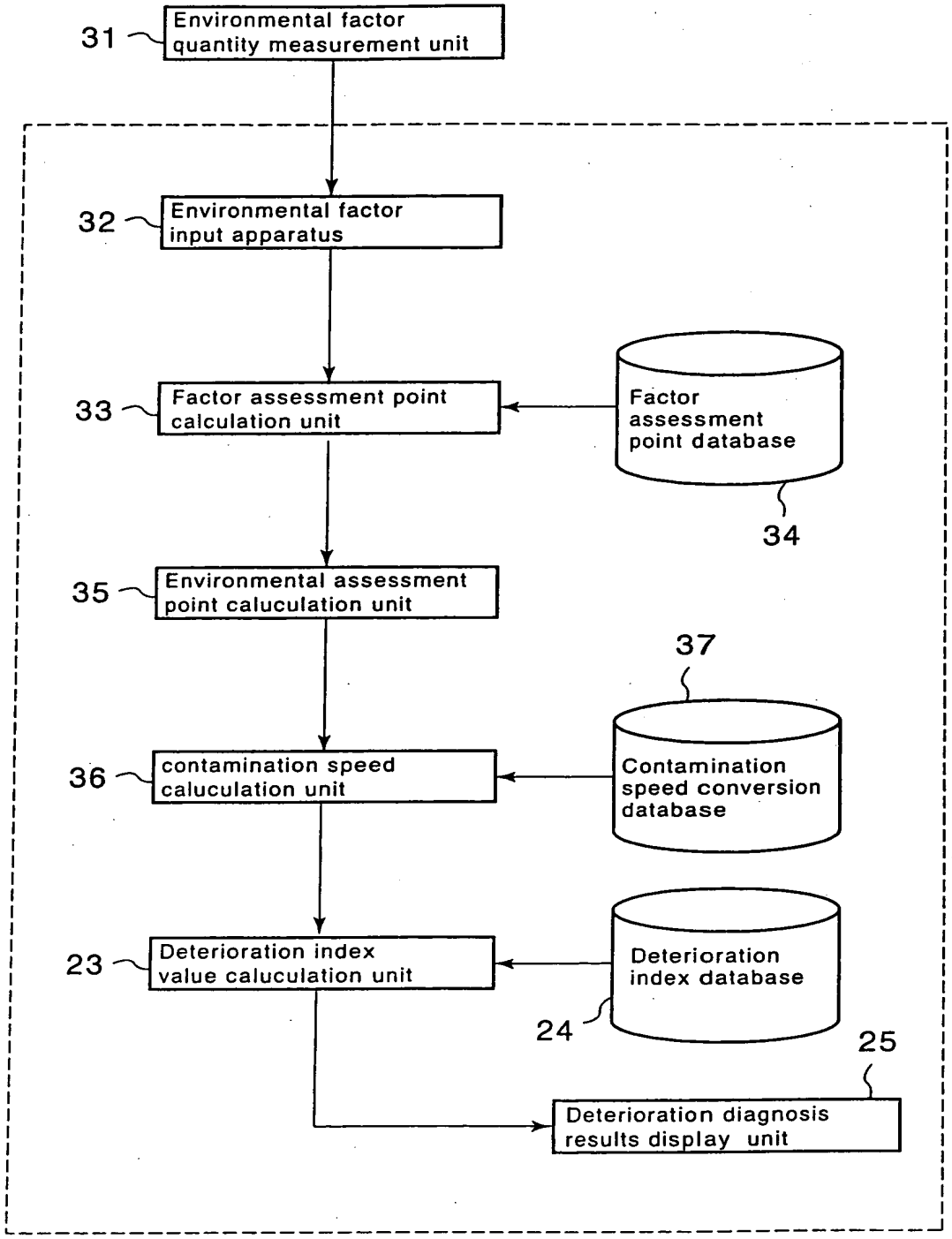

31
Environmental factor quantity measurement unit
32
Environmental factor input apparatus
33
Factor assessment point calculation unit
Factor assessment point database
34
35
Environmental assessment point caluculation unit
37
36
contamination speed caluculation unit
Contamination speed conversion database
23
Deterioration index value caluculation unit
Deterioration index database
24
25
Deterioration diagnosis results display unit

FIG.20

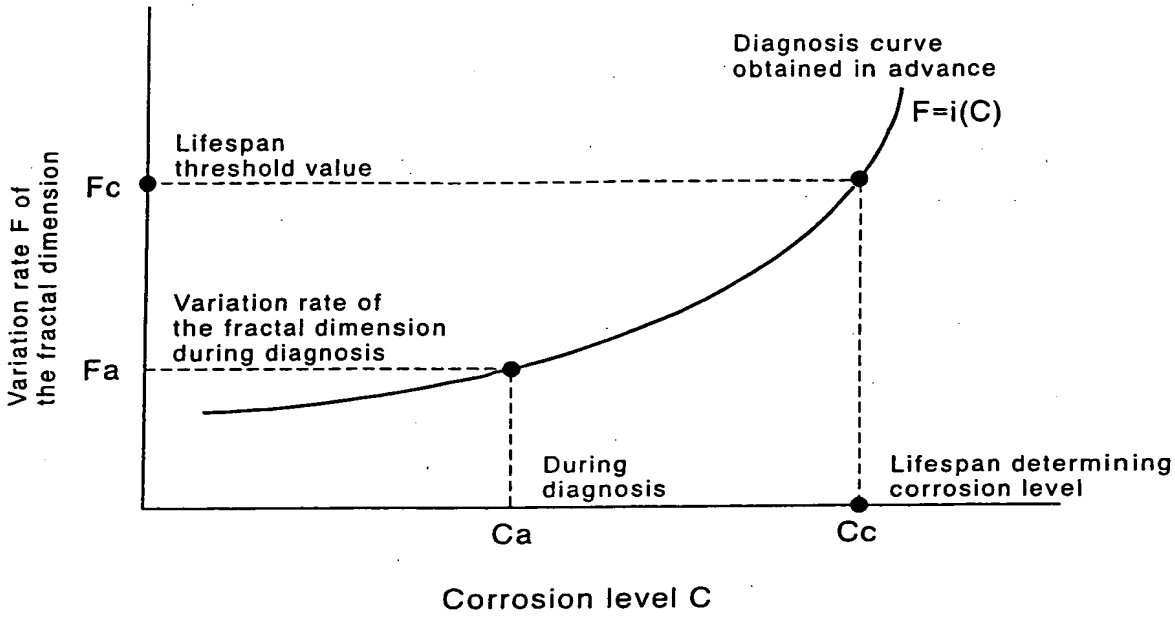

Diagnosis curve
obtained in advance
F=i(C)
Lifespan
threshold value
Fc
Variation rate F of
the fractal dimension
Variation rate of
the fractal dimension
during diagnosis
Fa
During
diagnosis
Lifespan determining
corrosion level
Ca
Cc
Corrosion level C

FIG.21

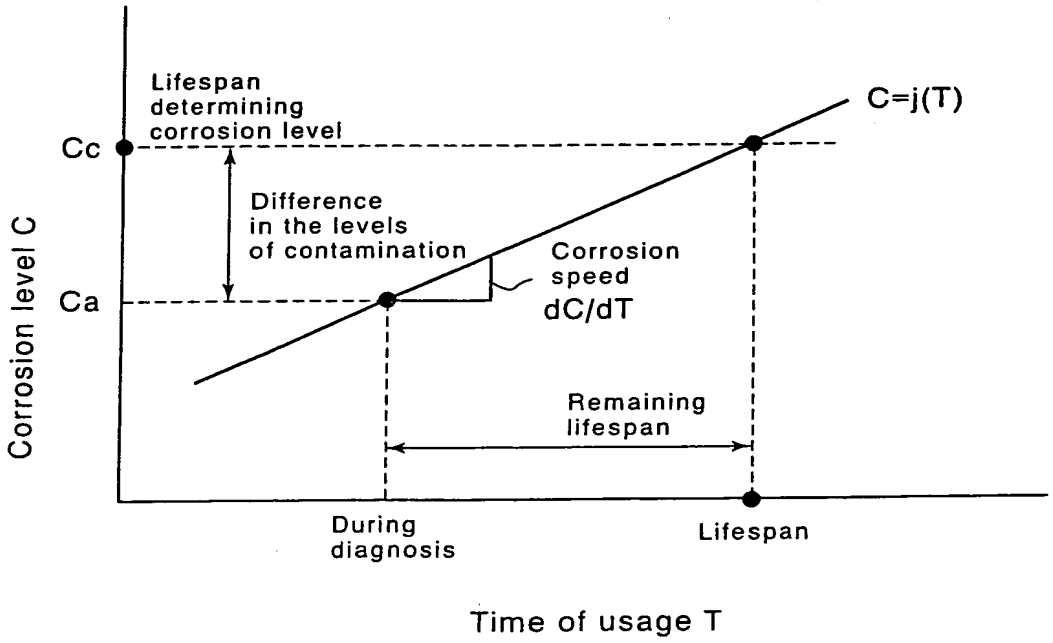

Lifespan
determining
corrosion level
C=j(T)
Cc
Difference
in the levels
of contamination
Corrosion
speed
dC/dT
Ca
Corrosion level C
Remaining
lifespan
During
diagnosis
Lifespan
Time of usage T

FIG.22

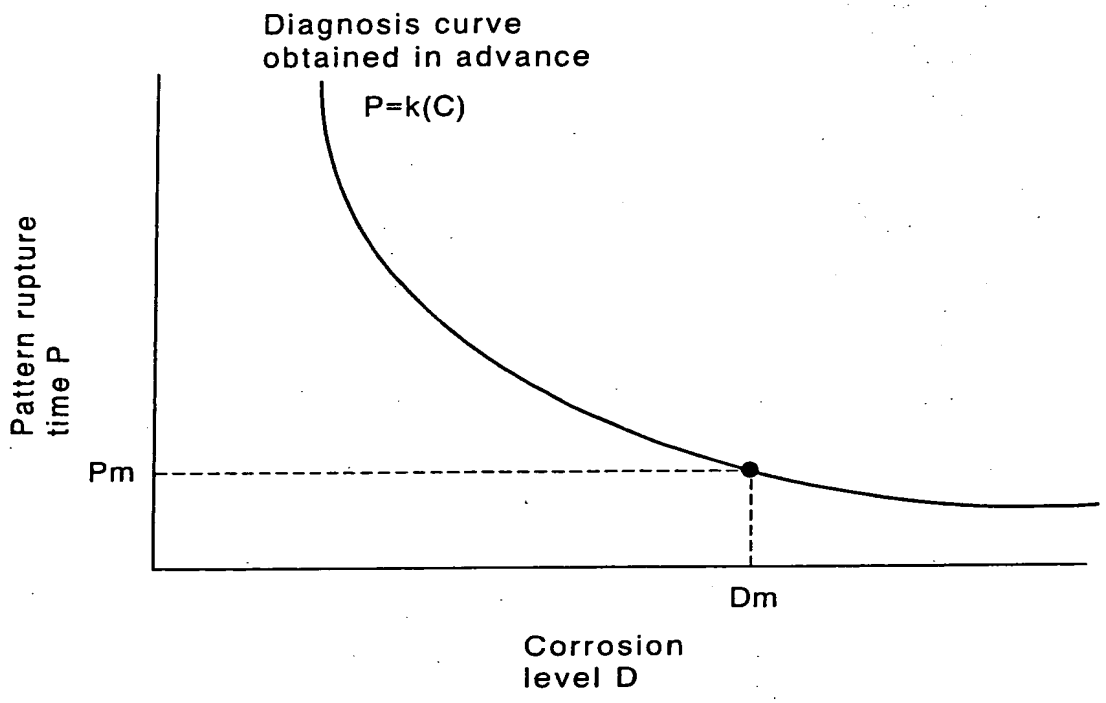

Diagnosis curve
obtained in advance
P=k(C)
Pattern rupture
time P
Pm
Dm
Corrosion
level D

FIG.23

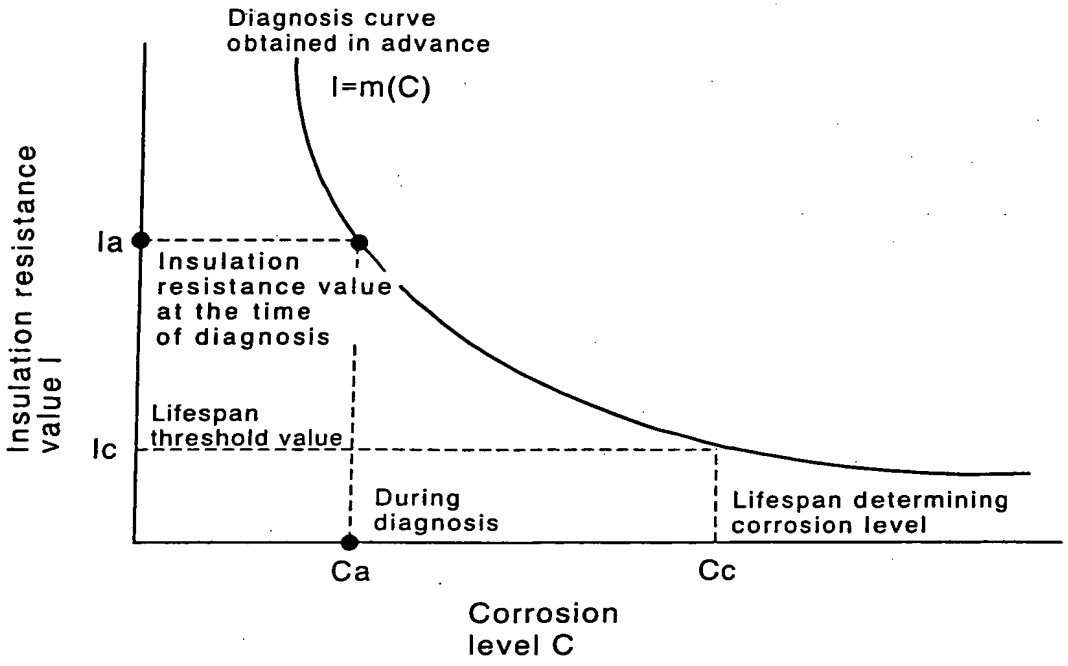

Diagnosis curve
obtained in advance
I=m(C)
Insulation resistance value I
Ia
Insulation resistance value at the time of diagnosis
Lifespan threshold value
Ic
During diagnosis
Lifespan determining corrosion level
Ca
Cc
Corrosion level C

FIG.24

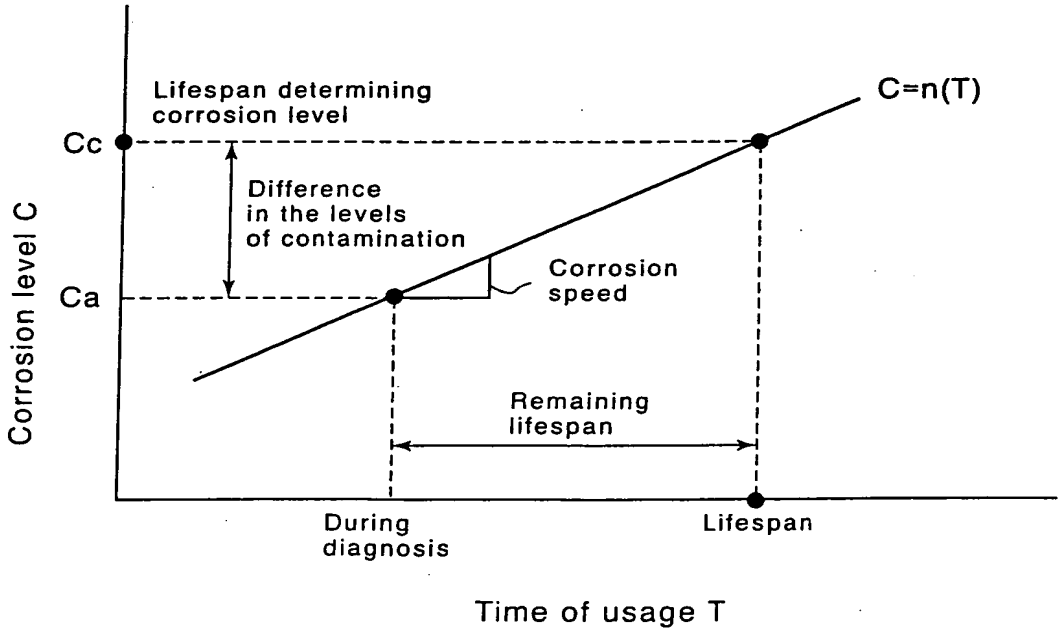

Lifespan determining corrosion level
C=n(T)
Cc
Difference in the levels of contamination
Corrosion speed
Ca
Corrosion level C
Remaining lifespan
During diagnosis
Lifespan
Time of usage T

FIG.25